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LANGUAGE AS A TOOL FOR SCIENTIFIC THINKING SKILLS: A CLIL PROPOSAL TO CONNECT VERBAL THOUGHT AND PUBLIC SPEECH IN PRIMARY EDUCATION

El lenguaje como herramienta para desarrollar habilidades de pensamiento científico: una propuesta CLIL para conectar el pensamiento verbal y el discurso público en Educación Primaria

FINAL DEGREE PROJECT IN PRIMARY EDUCATION
MENTION IN FOREIGN LANGUAGE: ENGLISH

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ABSTRACT

This Final Degree Project presents a didactic proposal designed as part of an educational research study on interdisciplinary learning in Primary Education. The main objective is to analyse how the use of instructional text supports students in structuring their verbal thought and transforming it into public speech. The proposal integrates Natural Science (forces and structures) and computational thinking (robotics and programming) within a CLIL framework, applying task-based learning and cooperative methodologies. The research focuses on a twelve-session programme implemented in a bilingual school, where instructional texts systematically guide students in planning, describing, and sharing processes during problem-solving tasks and scientific experiments. The final product is a science fair where students present and explain their work to peers, using the instructional texts they have developed as a tool for public communication.

KEYWORDS: CLIL, Primary Education, instructional text, verbal thought, public speech, interdisciplinary learning, active methodologies.

RESUMEN

Este Trabajo de Fin de Grado presenta una propuesta didáctica diseñada como parte de un estudio educativo sobre el aprendizaje interdisciplinar en Educación Primaria. El principal objetivo es analizar cómo el uso del texto instructivo ayuda a los alumnos a estructurar su pensamiento verbal y transformarlo en discurso público. La propuesta integra Ciencias Naturales (fuerzas y estructuras) y pensamiento computacional (robótica y programación) dentro de un enfoque AICLE, aplicando aprendizaje basado en tareas y metodologías cooperativas. La investigación se centra en un programa de doce sesiones implementado en un colegio bilingüe, donde los textos instructivos guían de forma sistemática a los alumnos en la planificación, descripción y comunicación de procesos durante actividades de resolución de problemas y experimentos científicos. El producto final es una feria científica en la que los alumnos presentan y explican su trabajo a sus compañeros, utilizando los textos instructivos elaborados como herramienta para la comunicación pública.

PALABRAS CLAVE: AICLE, Educación Primaria, texto instructivo, pensamiento verbal, discurso público, aprendizaje interdisciplinar, metodologías activas.

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1.INTRODUCTION

In today's society, marked by constant scientific and technological changes, the abundance and accessibility of information, and the need for critical and autonomous citizens, education faces the challenge of preparing students by offering learning experiences that go beyond the accumulation of knowledge towards a competence-based and meaningful development. It is essential to promote didactic situations in which students develop competences while acting reflectively and solving problems, communicating effectively in different contexts. In addition, the current educational legislation in Spain, the Organic Law 3/2020 (LOMLOE), highlights the importance of ensuring that student learning is competence-based and starts from their real environment.

This is the context in which this Final Degree Project is framed. The research starts from a guiding question that shapes the entire design and analysis: how can discourse, language, become an effective tool to guide and structure students' scientific thinking and help the transition from verbal thought to public speech? The aim was for students to internalise the different steps, sequences and analyses involved in scientific knowledge and be able to express them in an effective communicative way to lead others during experimentation.

To achieve this, a didactic design is proposed that combines the areas of Natural Science, Social Science and Foreign Language through a CLIL approach in a real bilingual context with a second-year group from the first stage of primary school. This design is based on active methodologies such as Task-Based Learning, Challenge-Based Learning and Design Thinking, among others. The idea was to create a methodological combination that would enrich the situation and promote the functional and meaningful development of competences and knowledge.

One of the central elements of both the proposal and the research has been the use of instructional text as a discursive structure that helps guide students' thinking and action. This text type was chosen for its functional value, that is, its ability to help students connect thinking with language. The linguistic structures it proposes are easy to internalise and can easily be supported by gestures and visual cues, thus helping to reach students' inner speech and then their verbal thought.

The project is structured around a final product with great educational value: the science fair. In this last lesson, students face the challenge of leading other students from different primary levels through an experiment using discourse they have worked on beforehand. This is not intended to be just an oral presentation, but rather a communicative challenge in which students must adapt and transfer what they have learned in previous lessons, showing the direct link between verbal thought and public speech.

Finally, this Final Degree Project aims to show that a didactic design that is aware of the value of language, focused on functional and reflective use of discourse, not only promotes the learning of scientific and linguistic content, but also helps to form students who are critical, autonomous and able to think and communicate with coherence. The study invites reflection on the central role of language in science teaching and in the development of scientific thinking that is visible, shared and applied in real contexts.

2.OBJECTIVES

The general objective of this proposal is to analyse how the design of discourse helps connect verbal thought with public speech in the development of scientific thinking in Primary Education students. To achieve this objective, an educational intervention plan is developed in the Social and Natural Sciences classroom within a bilingual educational context, following a CLIL approach.

The specific objectives of this research and Final Degree Project are:

- To design a didactic proposal that integrates the intentional use of instructional text as a tool to guide students' thinking and the development of experimentation following the scientific method.
- To plan and select a set of expressions that act as scaffolding for the sequencing of students' scientific thinking.
- To analyse the impact of the selected discourse on students' ability to lead others during experimentation in peer teaching lessons.
- To assess how the use of planned discourse contributes to the development of communicative competence in the foreign language in a CLIL environment.

- To explore the role of cooperative work in creating social and communicative settings that strengthen shared discourse.
- To promote a learning environment where Natural Science and Foreign Language content is taught functionally, integrated into tasks, challenges, and experiments.
- To evaluate the extent to which the didactic design enables students to transfer the internalised discourse to the leadership of experimental activities.
- To encourage metacognition, helping students to organise their reflections on whether they have met different criteria and to analyse their performance and work.
- To study how students identify and verbalise errors during an experimentation process, developing a reflective culture.

3.JUSTIFICATION

Current educational demands call for teaching in Natural and Social Sciences that goes beyond the traditional transmissive method focused on theoretical knowledge, promoting instead a more meaningful and experiential learning. The aim is to encourage the development of scientific, critical and reflective thinking. In a social context where information is abundant and easily accessible, there is a clear challenge: to prepare citizens who are able to live in complex and constantly changing societies. It is essential to provide students with tools and skills that enable them to ask questions, observe, analyse, and share their thoughts and ideas with the world around them. As Vygotsky (1978) pointed out, language is the means by which thinking is structured, experience is organised and action is mediated.

The choice of topic and design of this proposal stems from the need to analyse how planned discourse can act as a scaffolding tool that helps connect students' verbal thought with their public speech in the development of scientific thinking. This research defends the idea that language should not be just a tool for communication, but an intentionally designed resource to help students sequence their actions, plan experiments, formulate hypotheses and analyse results, with the final step being their ability to guide others through an experiment. In this way, the aim is to show that the planning of discourse is a key element in didactic design, directly impacting both scientific and communicative competences.

From a pedagogical perspective, this proposal is based on a theoretical framework that combines principles of the socioconstructivist approach and Vygotsky's theory of thought and language (1934, 1978), together with cooperative learning (Johnson & Johnson, 1999), challenge-based learning (Nichols & Cator, 2008) and task-based learning (Ellis, 2003). All of these approaches stress that language and social interaction are the drivers of competence development. In this proposal, students must integrate scientific concepts and knowledge with linguistic knowledge through a meaningful, functional and experiential process that allows them to act on reality and communicate effectively.

In terms of current legal requirements, this proposal responds directly to what is set out in educational law. The LOMLOE, and more specifically Decree 38/2022 of Castilla y León, place the development of key competences at the centre of the educational process, promoting cooperative learning situations, student autonomy and formative assessment. This proposal clearly contributes to the development of communicative competence, scientific competence, learning to learn, and social and civic competences, while also addressing the specific competences of Natural Science, Social Science and Foreign Language. The methodology follows a CLIL approach, where discourse and language serve as vehicles for learning content, and linguistic competences are developed through this use. Furthermore, the proposal aligns with the levels and descriptors of the Common European Framework of Reference (CEFR), ensuring that English is functional and accessible, allowing students to communicate using simple structures adapted to their level.

The relevance of this research lies in its real functionality in primary classrooms, as this connection between thought and discourse is still rarely implemented, especially in bilingual contexts. This Final Degree Project explores how a specific text type can act as a bridge between students' internal thinking and their ability to communicate, in particular by leading a scientific process. The proposal does not limit discourse to linguistic support, but places it at the centre, as the backbone of both students' mental planning and the communicative act in peer teaching.

Another reason that justifies this work is its applicability and transferability to other educational contexts. The proposal is designed for a specific context but can be easily

adapted and redesigned for other levels, contexts or content. This project also contributes to teachers' reflection on the need to plan discourse carefully in order to enhance learning and achieve effective and real communication between teacher and students. But this is not only from a communicative point of view, but also from a pedagogical one, as discourse is key to developing competences beyond the communicative.

Finally, this proposal addresses the need to develop students' reflection and metacognitive skills at an early age. The ability to reflect on one's own thinking and to learn how to learn is essential for deeper learning (McGuinness, 1999). In this proposal, discourse helps students become aware of their own learning process, identifying errors and seeking justified solutions. In this way, it contributes to creating a reflective and critical classroom environment where mistakes are seen as an essential part of learning.

In conclusion, this Final Degree Project is justified by its contribution to quality education, based on the development of competences and the integration of language and science content. All of this is done using discourse as a thinking tool and creating learning environments where students take an active role in building knowledge. The aim is to offer a rigorous and coherent didactic proposal that responds to the current challenges and demands of education.

4.THEORICAL FRAMEWORK

This proposal's theoretical basis revolves around several key concepts. It particularly highlights the development of scientific thinking in early ages, specifically in the first cycle of Primary Education, through meaningful practical experiences. Also crucial is the use of language as a cornerstone for effective thought mediation and a learning tool.

The proposal is also based on cooperative learning and metacognition to enhance both intrapersonal and interpersonal basic competencies. All of this is approached with an active methodological focus, integrating content from various subjects and using a competency-based approach that involves solving problems through challenges.

These pillars form the foundation of this teaching proposal, which was implemented in the second year of Primary Education. In this setting, children are at the forefront of their learning by planning, carrying out, presenting, and guiding a scientific experiment.

SCIENCE AS A PROCESS

In Primary Education, we should promote a competency-based learning approach that prepares students for real-world situations. We shouldn't reduce teaching to just rote memorization of theoretical knowledge (Zabala & Arnau, 2014).

Specifically, science education needs an active, experiential focus. The goal isn't just to learn facts, but to develop skills related to science, emphasizing its processes (Harlen, 2010). Observation, hypothesis formulation, analysis, and experimentation should be the competencies we aim to develop, rather than simply memorizing data or definitions (Osborne & Dillon, 2008).

Many authors discuss the importance of offering children real inquiry experiences, adapted to their level, but still allowing them to follow the steps of the scientific method (Harlen, 2001). Wynne Harlen (2001) argues that the way for develop a good learning experience for students is learning by doing, breaking away from the traditional, transmissive approach to science learning.

In this didactic proposal, students are presented with a "challenge" to overcome with limited instructions. The challenge of building a bridge that can support certain weights isn't seen as a final product or task. Instead, it's intended to be a scientific process where students question, predict, test, and finally analyze and revise. The goal is for students to internalize the scientific method so deeply that they can even guide others through it.

LANGUAGE AND SCIENTIFIC THINKING

Language plays a crucial role in developing scientific thinking, especially in childhood. It not only helps us build and organize ideas, but also to share and compare them with others. From Vygotsky's sociocultural perspective (1934), thinking isn't just an individual process; it's a social activity that benefits from interaction and communication with the environment.

In a science classroom, it's clear that verbal thought and public speech are linked as parts of a cognitive process. Language isn't only a mediator of communication, but also of thought—it's the way we think. Vygotsky (1934) argues that thought and language combine to form verbal thought. Children take in information through communication and create internal structures in their inner speech, which then influence their verbal thought. This language we use to think eventually becomes public speech when we intend to communicate in a social setting.

Our ideas and thoughts often appear fragmented and disorganized in our inner speech. However, this internal thought starts to get organized when we use language, and that's when verbal thought emerges. This verbal thought then gets prepared to be presented to others, adapting to the context and other cultural elements to achieve successful communication. As Mercer and Littleton (2007) point out, this transition from private thought to public discourse is enhanced in cooperative situations, where language acts as a catalyst for shared thinking and meaningful learning.

In line with this, McGuinness (1999) highlights the importance of explicit strategies for teaching thinking skills, showing that language-based tools such as instructional texts and structured talk help students externalise and refine their thought processes. McGuinness' work stresses that effective teaching of thinking requires the creation of classroom environments where children are provided with clear cognitive frameworks that support reasoning and problem-solving. She argues that instructional texts, talk frames, and planning templates give children the structure they need to make their thought processes visible and manageable, encouraging metacognitive reflection as part of learning. By embedding these supports into the teaching of science, teachers can help learners not only to engage with content, but to actively process and communicate their reasoning in ways that are socially and academically meaningful. McGuinness' approach aligns with the aims of this proposal, as it focuses on empowering students to take control of their thinking through structured language use, fostering both cognitive autonomy and collaborative dialogue. These strategies, as she notes, are particularly valuable in contexts where students are working in a second language or developing new academic discourses, as they reduce cognitive overload and provide scaffolds for success.

In this teaching proposal, we will focus on intervening and acting in this process of structuring and sequencing scientific thought. By relying on cooperative work, students will constantly organize their verbal thought to present their proposals and ideas for solving the different challenges. This sequenced thought structure is also reinforced by using instructional text. When conducting an experiment and guiding others, we'll use simple imperative structures that will influence both the listeners' and our students' verbal thought, so they can guide others in the final science fair. The instructional text not only provides a clear linguistic model (based on imperative and sequential structures) but also serves as an external guide for thinking, allowing students to transform their reasoning into organized and communicable actions.

The connection of all these elements to the scientific method is also key here. This method is essentially a sequence we can use to frame thinking, thereby encouraging students to organize their thoughts into steps, with a final analysis of the results after the question "Does it work?".

Ultimately, both the use of instructional text and the application of the scientific method offer students external structures that support their cognitive and linguistic development. This allows them to progress from individual thought to shared discourse in real communication and teaching contexts.

COOPERATIVE LEARNING

Johnson and Johnson (1999) affirm that cooperative learning is based on five key elements: positive interdependence, individual accountability, promotive interaction, interpersonal skills, and group processing. This method not only encourages the development of specific subject-area competencies related to the learning situation but also helps to develop civic and interpersonal skills.

This is where the role each group member assumes in the teaching proposal becomes important. Roles should be assigned thoughtfully, distributing duties where students feel comfortable, can develop, and where an effective and secure working environment is created. For instance, less participative children could be made spokespersons to help them overcome their fear of group exposure, or even to keep them cognitively active and

focused on the discussion. As the various challenges are presented, students must collaborate, share ideas, and reach agreements within their small, carefully designed groups. This way, small working societies are formed where students will develop skills related to teamwork, interpersonal interactions, and living in society.

Furthermore, cooperative work not only promotes the development of the aforementioned competences but also creates opportunities for developing socio-emotional skills such as empathy, patience, and the ability to accept and adapt. To get the most out of this method, a group work culture must be fostered where students can form hypotheses and propose solutions in an atmosphere of mutual group support.

METACOGNITION: AWARENESS OF ONE'S OWN THINKING

There is a growing need to talk about the ability to regulate, direct, and focus one's own mental and cognitive activity. This ability is known as metacognition. Flavell (1979) defines it as the knowledge and control a person has over their own cognitive processes. In other words, metacognition means being aware of how I learn.

Focusing on the educational perspective, the work of Carol McGuinness (1999) stands out. She emphasizes that thinking involves teaching students to reflect on their own thought processes. By doing this, truly meaningful learning can take place. To learn how to learn, McGuinness identifies five essential modes of thinking related to metacognition:

- Critical Thinking: This is central to scientific reasoning. It includes cognitive skills that help students form hypotheses, make predictions, justify their ideas objectively, and select appropriate sources. In this particular teaching proposal, it shows up in several moments of the learning sequence — for example, when students must decide and justify the design of their construction, or the programming sequence for Kubot, or when they predict whether a certain structure will hold a specific weight.
- Creative Thinking: This skill comes into play when students are looking for solutions during the building or redesign process. It is linked to the ability to generate ideas and combine elements in a lateral and innovative way.

- **Decision-Making:** This becomes most evident when students work on a group action plan. It involves skills such as evaluating different options by analysing their pros and cons, with the aim of choosing the most suitable one for their needs.
- **Problem-Solving:** This is a process that begins when students face a problematic situation for instance, one of the challenges we plan to present. They need to propose several possible solutions and select the one that best fits the context. When faced with scientific challenges, students naturally activate this skill by analysing new situations and deciding how to respond.
- **Seeking Understanding:** This appears when students interpret what happens to structures under different circumstances, when they classify materials by properties, or when they reflect on similarities between designs. It involves skills such as comparing, contrasting, identifying, and making connections.

These five dimensions of metacognition are clearly interconnected and revolve around a central concept: metacognition itself. In this way, students are encouraged to move beyond acting on impulse and to respond in a more thoughtful, strategic, and organised manner. In the cooperative and challenge-based learning environment we propose, students reflect, structure their own thinking, and adjust their strategies and behaviours through shared experiences.

Finally, the final product, the presentation at the Science Fair, requires an even higher level of metacognitive effort. Students must select relevant information, organise it logically and sequentially, and adapt their speech to suit different audiences. This process encourages autonomy and helps them take an active role in their own learning.

INSTRUCTIVE TEXT TO SEQUENCE THINKING

In the context of CLIL learning, as proposed here, the instructive text is one of the most useful tools to sequence thinking processes and connect language, thinking, and practice. Thanks to this type of text, students are offered fully functional language structures in real contexts and, along with them, the ability to organise ideas, plan, and communicate actions in a structured and sequenced way.

Focusing on the linguistic side, this type of text is characterised by a sequence of short, clear, and direct imperative structures. In this way, a sequence of different imperative sentences is presented, usually with a time adverb, which can also be replaced by a number in the text design, to make it easier to identify the different steps of the experiment. As Gibbons (2009) points out, functional texts like instructive ones allow us to take the focus away from what is being learned in the linguistic field. It is not only about learning the language, but also learning through it, integrating content with language and thinking.

In reference to this teaching proposal, the text becomes a tool for metacognition, allowing students to verbalise and organise their thinking, following a purely scientific sequence. For example, when students present and guide their peers through an experiment, they must be aware of the order of the steps and empathise with the person receiving the message. In this way, a space is created to develop both linguistic and intrapersonal competence, becoming aware of how they think and how they communicate that thinking.

In the proposed teaching situation, the instructive text is not limited to its comprehension, but is extended to the production, adaptation, and transmission of the instructions depending on the communicative context of each group they interact with. In other words, this type of text will be key to transforming students' knowledge and competences into discourse that helps build shared learning.

Following the principles of the CLIL approach, learning should promote the development of curricular content from different subjects through the use of language; in this case, a foreign language. With this dual objective in mind, it is very effective to combine practical and experience-based methodologies that encourage communicative situations and meaningful learning. In this teaching proposal, Challenge-Based Learning and Task-Based Learning are integrated.

Starting from an educational initiative by Apple, Nichols and Cator (2008) developed Challenge-Based Learning, which suggests guiding learning situations around the solution of a meaningful challenge that is open to different possible answers. The aim of this methodology is to encourage student involvement and collaboration. Through

analysis and critical thinking, students are expected to offer solutions to a real problem, supported and justified with reasons.

On the other hand, Task-Based Learning started in the field of foreign language teaching (Willis, 1996; Ellis, 2003). This methodology proposes that learning happens through solving subtasks that lead and prepare students for the final task. The language focus is placed on using the language as a tool to solve those tasks, creating a safe and communicative environment where nobody is judged.

Both methodological approaches can be integrated in a global way. TBL gives us the structure to organise our teaching design, and the final task becomes the challenge to solve. In other words, we keep the structure of TBL but follow the guidelines of CBL, aiming for students to complete subtasks that prepare and support the solution of the main challenge. This happens both in each specific lesson of the proposal, and also in a global way, where the final tasks are like puzzle pieces that come together in the final product, the presentation, the final challenge.

This methodological combination has already been explored in recent research. Fernández Fontecha and Fernández Álvarez (2020) show that in CLIL contexts, tasks can be designed as part of challenge-based sequences, which improves student engagement, oral interaction, and meaningful use of the language.

In this learning situation, a pedagogical design is created in which a final task is planned, a challenge in which students must present and guide their classmates through an experiment. To prepare for and successfully complete this challenge, different subtasks are carried out during the lessons, all with a functional and communicative focus.

PEER TEACHING

Peer teaching is a methodology that promotes the development of competences and learning not only in the one who receives, but especially in the one who teaches. The theoretical basis of this methodology is mainly supported by the socio-constructivist theory of learning, which understands knowledge as a collective construction that is strengthened through interaction with others (Vygotsky, 1978). When students prepare

their speech and their intervention for the science fair, they make adjustments and adaptations depending on different communicative contexts. In doing so, they develop their communicative and interpersonal competence, but also reflect on how they learn, focusing on the thinking process behind the design.

In this teaching situation, students will need to organise their thinking in order to explain it step by step, always using instructional texts to give a truly functional use to language, connecting it with their thinking.

Teaching others makes the student acting as the teacher restructure and consolidate their knowledge and thinking, verbalising it and helping it reach the mind of the receiving student. Both roles benefit from this process, both emotionally and in terms of competence (Topping, 2005).

This learning situation will promote a moment of peer teaching in which students will go through different learning processes. They will restructure their knowledge in order to respond to different situations, and they will use functional language, both verbal and non-verbal, to guide others through learning. Moreover, confidence and motivation will be strengthened by offering students a challenge that involves autonomy and a sense of competence that boosts their self-concept. Empathy also plays a role, as students must be able to put themselves in the place of the receiver, anticipating their feelings and solving possible communication problems.

This methodology is strongly supported by various studies. According to Mercer (2000), peer interaction in cooperative learning leads to what he calls interthinking, a shared way of thinking that helps develop both individual and collective reasoning.

DESIGN THINKING IN PRIMARY EDUCATION

Design Thinking (DT) is a methodological approach that proposes situations where problems are solved through empathy, creativity, and iterative action. When applied in the classroom, it becomes a way to turn learning into an active process that is, of course, meaningful and experiential. In the educational context, this approach has been adapted to promote critical thinking, collaboration, and innovation (Lee, 2020).

Considering all these features, this methodology connects easily and logically with both CBL and metacognition, as mentioned before. David Lee (2020) proposes a DT model divided into five phases: Empathize, Define, Ideate, Prototype, and Test. Students deal with real problems, challenges, by exploring different possible solutions, communicating their ideas, and taking into account the particularities of each individual.

In this situation, students design a solution to a proposed challenge: building a structure that supports a certain weight, and later, presenting and guiding others through that same experiment. This process involves, once the problem is defined, creating and designing solutions, making tests and prototypes, checking predictions, and empathising with the audience to whom they will present the experiment at the science fair.

Design Thinking allows students to review their decisions and correct possible mistakes, justifying their choices and developing their scientific competence, with a focus on iterative thinking and metacognition. As Lee (2020) points out, students move from being receivers and consumers of knowledge to becoming creators of solutions.

DISCOURSE IN A CLIL CLASSROOM

When analysing the CLIL approach in teaching, the work of Christiane Dalton-Puffer (2007) must be highlighted. Dalton-Puffer places discourse at the centre of pedagogical action, using it as the main axis of content and language integrated learning. Language becomes the main tool for building knowledge, moving the classroom away from being content-based and turning it into more of a discursive space.

According to Dalton-Puffer, there are several discourse genres that are essential in a CLIL classroom: description, argumentation, and instruction, which is the type of text mainly used in this learning situation — though the others are also present in some way. According to her, the conscious and structured use of language allows students to develop both conceptual knowledge and communicative competence at the same time.

In this proposal, language is not only used to share information, but also, as mentioned before, to mediate thinking and regulate cognitive processes, such as formulating hypotheses or interpreting and analysing results.

In addition, the author also highlights that a CLIL classroom should offer opportunities where students can take part in meaningful oral interactions, asking questions, justifying their proposals, or teaching others, as happens in the final product. This is strongly connected to cooperative learning and peer teaching situations.

As the author states:

"The use of language in CLIL classrooms is not limited to naming content concepts, it involves engaging learners in discourse functions which are cognitively demanding and socially situated" (Dalton-Puffer, 2013, p. 227).

This approach fits perfectly with the methodological framework of this proposal, where language and discourse are used as tools to explore content and develop competences related to scientific knowledge and, of course, basic competences.

COMPETENCE-BASED LEARNING

In recent years, European theories and laws have mostly chosen to keep a competence-based approach. The previous behaviourist view, where the teacher was the transmitter of theoretical knowledge and students were passive receivers, has been left behind. Now, the goal is to transfer learning to real contexts, and to create independent, creative students who can make well-based decisions. With the competence-based approach, learning is understood as a process where students build knowledge, skills, attitudes, and values in real-life situations.

Throughout the 20th century, many authors argued that to develop competences in a real and meaningful way, students must have significant learning experiences. Perrenoud (2000) defines competence as the ability to use knowledge to act effectively in different situations. Tiana (2011) also highlights that, to teach competences, we need to teach students how to communicate, think, solve problems, analyse, and live together.

This teaching proposal clearly aims to develop competence-based learning. It creates a learning context and situation in which students can develop both their basic and specific competences, following the guidelines of the LOMLOE (Ley Orgánica 3/2020). Through a cross-curricular challenge, competences from different subjects are integrated, making it necessary to use skills that help analyse and solve problems using scientific knowledge. In this way, active and experience-based methodologies are combined, supporting students' integral development and competences. Boix Mansilla and Jackson (2011) point out in their work that cross-curricular challenges lead to deep, long-lasting, and transferable learning, as they connect knowledge with the real world.

To keep this competence-based approach strong, one of the main pillars is the already mentioned experiential learning. In this kind of learning, knowledge is built through meaningful action. John Dewey (1938) defended that learning comes from living life in the classroom, not preparing for it. Kolb (1984) developed experiential learning as a cycle that mixes experience, reflection, and experimentation. The experiential learning proposed in this teaching unit is also connected to the idea of “learning by doing”, supported by recent research such as Ramos-Morcillo et al. (2021), who state that competence-based methodologies increase student involvement, develop critical thinking, and create environments where learning is better remembered over time.

The science fair becomes the final moment of this competence-based learning. Students are not just expected to show or repeat what they know, they must use the skills developed during the unit to communicate, argue, and guide others through experimentation. The student will not only understand knowledge, but will use techniques to interpret it, adapt it, put it into context, and share it.

FORMATIVE ASSESSMENT AND COMPETENCE

For this teaching unit, assessment is seen more as part of the learning process than as a final judgement, even if it may later become one. With this formative approach to assessment, students are encouraged to reflect individually and together on what, how much, and how they have learned (Black & Wiliam, 1998). The final product, something material, is not the main focus; instead, what will be assessed continuously are the strategies, decisions, and attitudes that students show during the different sessions.

Later in the development of the session, the specific methods for both teacher assessment and self and peer assessment are explained. The aim is to create a reflective classroom culture where assessment becomes something natural and part of daily life, and where it helps develop learning and competences in a meaningful way, moving away from the idea of isolated and grading-focused assessment. In this way, the idea is aligned with authors like Darling-Hammond and Adamson (2014), who refer to “authentic assessment” as the kind that values real tasks, where students can show what they are able to do.

THE SCIENCE FAIR AS FINAL PRODUCT

The science fair will be the final product, the challenge that students will have to solve as a way to consolidate their competence development in an authentic and final way. The objective is not only for the students to share the instructions or the work they have done, but also to guide others, just as they were guided through discourse and thinking when doing the experiment. The students will have to become teachers, think about what to say, how to say it, and adapt it to the level of the person they are interacting with.

This is a situation where they must use all the competences they have developed during the different subtasks of the lessons to carry out an effective communicative act, helping every student to succeed in the task. Teaching and guiding others helps to reinforce the knowledge learned, through a social metacognition process. According to Palincsar and Brown (1984), when we guide others, we reorganise our own knowledge and become aware of our own cognitive processes.

The science fair is not just a simple presentation or evaluation, it is a final challenge that clearly reinforces the competences developed throughout the proposal, such as scientific thinking, communication and language, and awareness of learning processes. In this task, all the key aspects of the project come together: cooperative work, experiential and competence-based learning, scientific thinking, the use of the foreign language as a tool, and the development of key competences.

In short, the science fair brings the project to an end by placing the student at the centre of the action, making them the main character in a learning experience where they can show their competences to the educational community.

5.PROPOSAL DESIGN

In this section, I present the designs of the materials created for the implementation of my teaching unit. These designs include observation sheets, instructional texts, assessment tools and other support documents. All of them are aimed at helping students to understand the tasks, reflect on their learning and work cooperatively.

CONTEXT

This teaching proposal is set in a state-subsidised school located in the city centre of a provincial capital in Castilla y León. The school is bilingual, and therefore Science subjects are taught in a foreign language following the CLIL approach throughout Primary Education. Within the Educational Project (PEC), the school includes a Plurilingual Education Plan (PIPE), which sets out specific measures to obtain external certifications in foreign languages and promotes cultural activities related to Anglo-Saxon culture during school hours. This proposal aligns with the methodological principles of the school's Bilingual Plan. As part of the PIPE programme, students from different year groups interact at certain moments throughout the year to present content, such as describing a leprechaun for Saint Patrick's Day. This provides a strong foundation of prior knowledge and will support the development of the science fair. I was able to see first-hand how this bilingual setting provides rich opportunities to develop communicative competence, both in the students' mother tongue and in English.

The reference group for this proposal is class 2ºB, a cohort of 25 seven- to eight-year-olds (13 girls, 12 boys). They exhibit strong oral communicative skills in English, often expressing themselves fluently even without fully grammatical accuracy, and effectively complement their speech with non-verbal gestures. They are also accustomed to producing classroom displays and delivering simple oral presentations in English, which reinforces their confidence in meaningful communication. While they face more challenges in reading and writing, their enthusiasm for experiential, cooperative tasks makes the use of instructional texts with simple imperative structures particularly suitable for their learning process.

Students regularly work in small cooperative groups with assigned roles, which fosters individual and collective responsibility as well as metacognitive thinking—elements that, according to Mercer (2000), are essential for meaning-making through dialogue. Learning takes place not only in the classroom but also in wider school spaces equipped with ICT tools, manipulatives, research materials, and a science laboratory, supporting a dynamic, inclusive, and civic-oriented learning environment.

Furthermore, the group follows an official agreement with Cambridge Assessment English to assess and certify their foreign language proficiency through recognized exams (e.g., Pre-A1 Starters, A1 Movers, A2 Flyers), ensuring consistent, measurable progress in communicative competence across educational stages. These elements provide a solid foundation for designing a coherent and meaningful sequence of lessons tailored to the group's specific characteristics and opportunities.

CURRICULAR JUSTIFICATION

The legislative framework in which this didactic proposal is based is the LOMLOE, specifically developed for the region of Castilla y León through Decree 38/2022 of September 29. These two official documents regulate the Primary Education curriculum in our context, establishing guidelines such as focusing on the integral development of students through key competences, helping them to develop personal, social, and professional skills.

During the 12 sessions of this proposal, students will have to solve problems in cooperative environments, make decisions, and focus on communication in English as a foreign language, using an interdisciplinary and CLIL approach.

This proposal especially contributes to develop many key competences such as:

- Competence in linguistic communication: through group interaction and peer teaching situations, during the production and communication of instructional texts, and in oral presentations. Communication is essential, especially in a socially interactive setting like this one, based on cooperative work.
- Mathematical competence and competence in science, technology and engineering: experimentation is a central pillar in all the tasks, such as building

structures or programming with Kubo. Through experimentation, students are expected to observe, analyse, and go back to their predictions in order to reformulate hypotheses and solve the challenge, like building a stable structure.

- Digital competence: especially when using digital tools such as Kubo and working with sequenced programming.
- Personal, social and learning to learn competence: this competence is always being developed, from the final metacognitive routines to the daily classroom work. The goal is that students become aware of their own learning process and develop respectful and cooperative relationships with others. Civic competence is also included here, especially when working outside the classroom.

This does not mean that the other key competences are not addressed, but rather that these are the most prominently developed in this proposal. In addition, specific competences of the Natural Sciences, Social Sciences, and Foreign Language areas are also addressed. For example, in Natural Sciences, competence 2 (“To ask and answer simple scientific questions about the natural environment, using different techniques, instruments and models related to scientific thinking, to interpret and explain facts and phenomena in nature.”) is developed through the inquiry-based challenge; or competence 3 (“To solve problems through interdisciplinary design projects and the application of computational thinking, to cooperatively create a creative and innovative product that answers specific needs.”) when preparing the science fair, among others. The same happens in Foreign Language, where all the specific competences are developed. The most evident ones are competence 3 (“To interact with others using daily expressions, applying cooperation strategies and using digital and analog tools, to respond to immediate needs of interest in communicative situations, respecting politeness rules.”) and competence 4 (“To mediate in predictable situations, using strategies and knowledge, considering cognitive, social and cultural diversity to process and transmit basic and simple information in order to facilitate communication.”)

Keeping all areas in continuous connection and interdependence allows students to acquire knowledge in an integrated way, in a real situation, not just in theory. This makes learning more meaningful, useful, and real. As Harlen (2010) states, science education should go beyond explaining facts; students should understand natural scientific

processes. In this way, this proposal mainly develops both communicative and scientific competences.

METHODOLOGY

Following the methodological guidelines established by educational legislation, this proposal is based on an active, competency-based, and experiential conception of the learning process. It seeks to integrate different pedagogical and didactic approaches in a solid way to promote the implementation of authentic, hands-on, and communicative experiences, where English is used as a tool for those experiences—not as a collection of facts to memorise. In this CLIL proposal, language becomes the vehicle through which competences such as communication and problem-solving are developed, while linguistic and scientific knowledge is naturally internalised.

The integrated learning of content and language is the core and foundation of this whole didactic proposal. This CLIL approach (Dalton-Puffer, 2007) allows content from Science to be combined with a meaningful use of language as a medium of communication. The proposal uses instructional text as the structure of each activity, because of its sequencing nature and its composition using imperative sentences—short and simple language structures that are easy to understand and can be reinforced with non-verbal language. This shows that language is understood as a tool to support thinking and cognitive development (Vygotsky, 1978).

It is also important to highlight that this proposal combines Task-Based Learning (TBL) and Challenge-Based Learning (CBL), as mentioned in the theoretical framework. Each session contains a main task, which presents a real challenge that requires investigation, experimentation, decision-making, and collaboration. The final task of each lesson is a challenge that students are able to solve successfully thanks to the completion of the subtasks in the session. This structure is followed throughout the entire unit: all final tasks contribute to the development of competences, skills and content that lead to the successful completion of the final challenge, which is presenting the experiment during the science fair. According to Nichols and Cator (2008), this challenge-based approach

increases commitment to problem-solving and teamwork. In this way, the tasks are not isolated exercises but steps that prepare students to teach others, which is the final goal.

Throughout the whole sequence, students will always work in cooperative groups, promoting positive interdependence and the development of social skills (Johnson & Johnson, 1999). The aim is to create learning environments where peer interaction leads to social reflection and supports interpersonal and communicative competences. Although this approach promotes autonomy, it requires careful teacher planning and close support to ensure that all groups make progress.

This is reinforced by the peer teaching component of the final challenge. As stated in the theoretical framework, teaching others helps to consolidate knowledge (Topping, 2005). The science fair becomes the culmination of this process of both scientific and communicative development, where students truly become active agents in the teaching-learning process. They do not learn from what is transmitted to them, but from what they transmit to others. Of course, the learning gained during the preparation is also very valuable.

It is also essential to understand that this proposal follows an inquiry-based approach, built on guided experimentation, observation and hypothesis formulation (Harlen, 2001, 2010). This allows students to explore in an environment where the teacher's guidance is hidden behind a false sense of freedom, giving learners the chance to feel ownership of their learning. At the same time, metacognition plays a key role in this proposal. Through individual reflection and the design of textual materials, students are able, as McGuinness (1999) explains, to identify what they have learned, how they have learned it, and become aware of their own thinking by organising it in sequences.

In the final sessions, another methodological strategy appears: Design Thinking. Students must empathise with the audience they are preparing their presentation for, in order to make the communicative act real and effective. In short, the methodology in this proposal promotes active, social, and contextualised learning, encouraging the development of students' competences.

Assessment Routine (Metacognition)

At the end of each lesson, all students take part in a routine dynamic of self and peer assessment. Each student has their own assessment chart where they write the names of the classmates they are going to assess (the members of their group) and their own name at the top of the table. On the side, they write the assessment criterion or criteria indicated by the teacher for that day.

From there, they evaluate the performance of each person listed in their chart using a simple and easy-to-understand colour scale, to which they can easily assign meaning:

- Red: I haven't done it or I didn't manage to do it.
- Yellow: I've done it, but it was difficult or with effort.
- Green: I've done it well and I felt confident.

This colour system allows students to express degrees of achievement without the pressure of numerical marks. It also provides immediate visual feedback that is easy to interpret and promotes emotional engagement with the learning process (McGuinness, 1999).

This routine encourages self-regulation and awareness of the learning process itself, as pointed out by Carol McGuinness (1999). It also promotes reflective environments where students develop objective and critical thinking, as well as individual responsibility towards their working group.

SEQUENCE OF LESSONS

The sequence of lessons in this didactic proposal has been carefully designed to respond to the characteristics of the group and the opportunities offered by the context. It consists of twelve lessons organised into two blocks: the first focused on programming and communication tasks, and the second on scientific experiments. This structure reflects a gradual progression in both cognitive and linguistic demands, allowing students to first acquire basic skills and strategies before applying them to more complex and interdisciplinary challenges.

The sequence is not a collection of isolated lessons, but a coherent pathway in which each session builds on previous learning and prepares students for the final goal: guiding their peers during the science fair. This is achieved by designing tasks that are logically connected, so that the competences and knowledge developed in one lesson provide the

foundation for the next. The first block provides practice in planning, sequencing actions and giving instructions through simple programming tasks. These skills are essential for the second block, where students must apply them to plan, conduct, and explain scientific experiments.

A key feature of the sequence is the systematic use of instructional text as an external tool for structuring thought. As McGuinness (1999) points out, providing explicit frameworks for thinking, such as instructional texts, helps learners to externalise their reasoning, organise it in logical steps and communicate it clearly. In this proposal, students begin by working with instructional texts provided by the teacher and gradually progress to creating their own, moving from guided practice to autonomous production. This process supports the transition from inner speech to public speech, as students learn to express their reasoning in a structured and communicative way.

The two blocks are closely connected: the first lays the linguistic and cognitive foundation through structured tasks with immediate feedback, while the second applies these competences to scientific inquiry. The design ensures that students experience continuity, reflection, and increasing responsibility, leading to the final science fair where they act as peer teachers and communicators. The schemes accompanying this section provide a visual summary of the content and progression of each block, complementing this description of the sequence and its educational purpose. A detailed explanation of the lessons can be found in **Annex 11: Sequence of Lessons for Developing Communicative Competence through Instructional Texts and Programming.**

BLOCK 1

Sequence of Lessons for Developing Communicative Competence
Through Instructional Texts and Programming With Kubo

Lesson 1	Introduce directions (turn right, turn left, go straight on). Cooperative task in pairs.
Lesson 2	Write instructional texts based on a map. Group work and peer evaluation.
Lesson 3	Give instructions to program Kubo. Correct the path if there's a mistake.
Lesson 4	Show Kubo to other students. Prepare an itinerant classroom demonstration.

Figure 1: Block 1 scheme

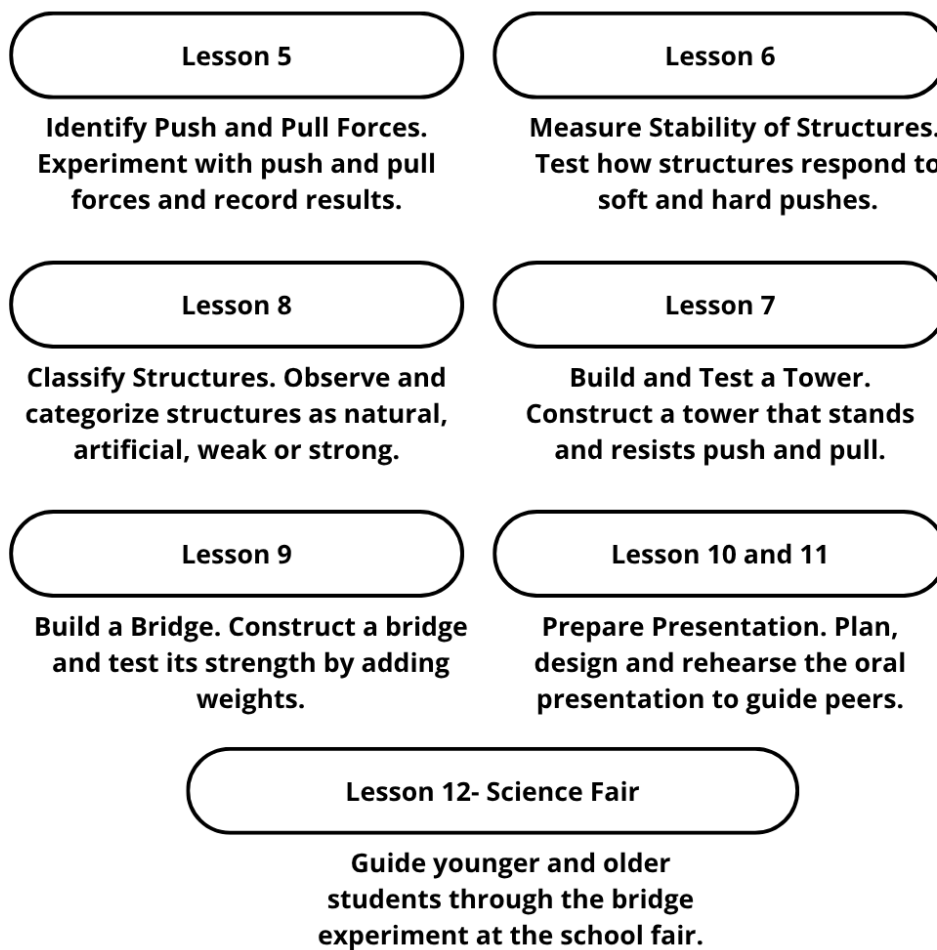


Figure 2: Block 2 Scheme

ASSESSMENT

The approach proposed for evaluating this project is competence-based, formative, and inclusive, in line with the principles established by the LOMLOE. The goal of assessment is not to simply check whether students have acquired the contents, but to accompany them throughout their learning process, creating opportunities for reflection and the development of key competences.

Following Zabala and Arnau (2014), assessing competences means evaluating how students use their knowledge and skills in an integrated way to solve problems or complete tasks. Assessment should be part of the learning process, not the final step. In this situation, the aim is to move away from the traditional "test." Mistakes are not penalised in this proposal; instead, they are seen as opportunities to build learning and develop competences. Mistakes and failures are understood as part of the learning process.

So, the question is: what is going to be assessed? During the different lessons, students are placed in cooperative and social environments where they must solve problems. This allows the teacher to observe and collect evidence of the students' learning progress. This evidence will be gathered through continuous and systematic observation by the teacher, monitoring student interaction, self and peer assessment routines, and the group work products created by the students. This information will help evaluate whether students can combine knowledge and competences to act effectively in real-life situations and successfully solve the different challenges. The assessment must be aligned with the evaluation criteria established by the current curriculum, in this case for both Science and Foreign Language areas.

Flavell (1979) argued that developing metacognition at an early age helps children become autonomous learners. For this reason, the pedagogical approach of this proposal focuses on continuous reflection and analysis of what students do and produce, and of the learning process itself. In other words, fostering the ability to learn how to learn also encourages autonomy and critical thinking.

Finally, the science fair will be the final product in which students demonstrate all their learning and competences in a real communicative context and through a challenging task. By explaining the processes to other students and adapting the explanation to their level, the groups will show that they are able to communicate effectively, that they truly understand the content, and that they can analyse their own thinking process.

6.ANALYSIS OF THE PROPOSAL

As it was formerly observed, the design of this teaching proposal was born from an essential question: How can language be used as a tool to guide and structure students' scientific thinking, helping them move from verbal thought to public speech? The aim was not for students to simply know the steps of an experiment and dictate them to others, but for them to master the knowledge and competences involved in carrying out a scientific experiment and be able to verbalise it publicly to lead others in doing it. The focus was on selecting a type of discourse that would help them sequence their thinking, influence their inner speech, and support the transition from verbal thought to public speech.

From the design phase, the intention was to choose functional, simple and useful language for the scientific field. After reflecting on the most common textual structures and the type of discourse needed to lead an experiment, we concluded that the discourse should follow the structure of an instructional text. As mentioned before, this logically connects the sequencing of the experiment steps with the sequencing of imperative sentences. The discourse also included expressions that could act as scaffolding for actions, reflections, and communication.

In this proposal, the discourse played a double role, acting as the core element that shaped the entire plan: to guide students' inner thinking and to support the transition from internal thought to public speech. First, the discourse was used to guide verbal thought. It was not only a communication tool but also key for students to sequence and structure scientific thinking. They referred back to the text whenever something needed to change, completing the sentences until they reached the point in the experiment where changes were needed. For example, in building the structures, after early failures,

many students expressed the need for an extra step: to reinforce the pillars between crafting and testing the construction.

The selected expressions and the discourse overall became a powerful metacognitive tool, helping students internalise the scientific method and develop a culture of reflection on what happened during the process, in search of improvements. In this way, the instructional texts helped establish a sequential model of scientific reasoning, as explained in the earlier example. Another clear case was during Kubo programming, where students verbalised their text: “Turn left, go straight on, turn left, turn right, go straight on...” When they didn’t achieve the challenge, they repeated the text in their private speech as Kubo followed the sequence, to identify where the adjustment was needed.

Using these simple structures helped students develop a kind of mental script linking verbal thought with the steps or actions to follow. As Vygotsky (1987) says, children use language not only to communicate, but to organise their actions and experiences. The chosen discourse structure was right for helping students master the scientific process and even verbalise adjustments aloud while interacting with classmates.

The type of discourse remained consistent, with few changes except in some tasks where closed questions were added to guide reflection on the success or failure of the challenge. At first, keeping the same structure might have seemed like it could slow progress, but in fact the opposite happened. As the lessons progressed, students became familiar with scientific thinking and often no longer needed the text to guide the experiment, using it only for support if necessary. This continuity allowed them to transform their verbal thought into functional public speech for solving group challenges.

Looking at the final challenges of Block 1 and Block 2, the Kubo presentation and leadership were successful, but did not reach the desired level of communicative ability. In Block 2, students showed that familiarity with the discourse structure helped them achieve excellent public speech. All students, at all levels, were able to communicate and guide others, whether more expressively or more through language itself, and all succeeded.

Their inner speech became so deep that at times they mixed languages. For example, while sequencing Kubo, one student said: “Es que has puesto turn right y es turn left.” or during science fair practice: “Con esos pillars es imposible que aguante la charge.” This shows that the linguistic content was truly part of their verbal thought.

At the science fair, the peak moment of the proposal, students generally showed that they not only mastered the discourse but also knew how and when to use different expressions and instructions. With younger students, they repeated messages rhythmically, with patience and empathy, using gestures to support communication while still speaking. With older students, they adapted their speech, sometimes moving away from full structures and using key words and non-verbal language to communicate and solve problems.

This progress in language use and discourse shows that the selected text type was not only appropriate, but essential in achieving the competence goals and developing both scientific and linguistic knowledge. Throughout the lessons, students progressed in making the discourse their own. They didn’t just use or repeat it; they integrated it into their thinking, into their verbal thought, and were able to apply it as public speech, adapting it to different communicative situations and intentions. As Mercer and Littleton (2007) state, shared language in the classroom supports shared thinking, and this was especially clear during the science fair.

The cooperative group work and careful assignment of roles strengthened not only students’ communicative competence but also helped address their weaknesses by building on their strengths. The group structure meant students had to interact in an organised and respectful way to propose solutions, make decisions, and reach agreements. For example, assigning students who struggled with keeping materials tidy as resource keepers helped significantly improve that skill. The responsibility was no longer just about their own things, but about the group’s materials, creating a sense of responsibility that strengthened this weakness. The same happened with the spokesperson role, given to those who found it hardest to participate. Gradual exposure helped them lose their fear of speaking, which supported group planning and preparation for the presentation. This collective responsibility freed students from fear

of mistakes and increased participation not only in these lessons but also in other subjects.

This was also supported by the self and peer assessment routine, which created a deeply reflective classroom atmosphere. Combined with the constant integration of scientific culture and method, this helped students see mistakes as part of learning. This was visible as lessons advanced, especially in sequencing and experimentation. At first, in Kubo programming, students participated little, wrote few sequences and texts, aiming for perfection to avoid mistakes. If they made mistakes, some deleted everything, though others could identify the exact point of error. It was in building and experimenting with structures that students learned to live with error. They designed and tested many prototypes, stayed motivated, analysed results and improved step by step until they succeeded.

As said in the context section, the group generally had no trouble communicating in the foreign language, even using single words, but in this section, a clear improvement can be seen in their use of linguistic content. In Block 1, they mainly used phrases like turn right or turn left with gestures. But as Block 2 progressed, students showed more flexible use of structures. Even those who found communication hard used phrases like Change the pillars, Try again, or Think and change to guide others. Sometimes they even built bilingual sentences, like: “No hombre, primero tenemos que Think in the experiment y luego ya nos ponemos con el craft.” showing that the language of the scientific method was part of their verbal thought.

In short, students’ progress across the lessons shows that discourse was the engine of thought, action and communication in these experiments. The planned language as a tool for sequencing and reflection helped students not only carry out experiments but really understand and internalise them, so they could guide others communicatively. The move from verbal thought to public speech was not accidental, but the result of a conscious effort that integrated language into both scientific and communicative processes, creating a deep, reflective, competence-based learning environment.

SUMMARY OF REGISTERED EVIDENCE

Throughout the implementation of this teaching proposal, the focus was placed on collecting and analysing evidence that confirmed the positive impact of the linguistic and methodological design on the development of students' communicative competence and critical and scientific thinking. The following table presents a summary of the most significant findings:

OBSERVED EVIDENCES	
Transition from verbal thought to public speech:	- Students used the proposed text structure to sequence the steps, both when talking to themselves and within the group. For example, in group 3 they said: "Push hard listo, ahora Record the results." - During analysis and redesign moments, students spontaneously returned to the designed discourse: "Put more pillars, Put pillars pero más fuertes..."; "Turn left, turn left... No! Turn left, go straight on, turn left." - In several situations, students created bilingual sequences showing the integration of language into their thinking and later into their public speech: "En vez de turn left, era turn right" or "Probad con unos strong pillars." - During the science fair, students adapted their speech to the audience's context, using a rhythmic presentation with Years 1 and 2, and adding variables to make the experiment more difficult, for example: "A charge heavy heavy now."
Evidence of the development of scientific thinking:	- Students showed progressive improvement in mastering the method. At first, the teacher asked questions (for example, during the tower experiment: "Does it fall or not?") to guide predictions. As they progressed, especially in the final lessons, students

	themselves verbalised predictions: “It falls” or “It not falls.” - Students went back to the design sequence after seeing their challenge fail and searched for the mistake in the planning or construction independently, without needing to repeat the whole sequence. - During construction lessons, students began asking for variables to change their experiments, saying things like “strong pillars”, “more pillars”, or “more plastiline.”
Evidence of the impact of cooperative work:	- The established roles supported equal participation and helped verbalise agreements and reflections. Spokespersons presented the group’s ideas in a clearer and more organised way as the lessons went on. Coordinators ensured the steps were followed correctly. Resource keepers showed significant improvement in their responsibility when managing materials. - Cooperative dynamics helped students who were more timid overcome communication blocks. When they took on roles such as spokesperson or coordinator, they visibly improved their confidence in expressing ideas in public. They themselves wanted to take an active role in the science fair, rather than avoid it.
Evidence of metacognition:	- Students who received lower peer assessment marks in the “work” criterion were warned by the teacher. Afterwards, they showed better attitudes and higher peer assessment scores in this area.

Table 1: Summary of registred evidences

These are the most notable pieces of evidence collected throughout the 12 lessons of this proposal. In this way, it was clear that students not only progressed in oral expression but also evolved in competences related to task sequencing, scientific thinking, and social responsibility, especially in group settings. These observations will

inform future designs, especially in providing differentiated scaffolding for students with greater communicative difficulties. In summary, the evidence collected shows clear progress in scientific reasoning, communication, and social responsibility, confirming the effectiveness of the design and suggesting areas for further exploration.

7.CONCLUSIONS

The main aim of this Final Degree Project, of this research, was to analyse how the selected language in the didactic design helps connect verbal thought with public speech in the development of scientific thinking in Primary Education students, specifically at early levels. From this perspective, the research has shown that careful planning and design of language turned into much more than just a communicative tool. The chosen discourse allowed students to organise their thinking in a sequenced way, guide their actions, and clearly project their structured knowledge and ideas outward in a way that was understandable.

In line with current methodological approaches and national and international legislation, education today must be formative and competence-based, preparing students to be people of the future. The aim is to move away from traditional transmissive models and promote situations where students do not just transmit or reproduce knowledge, but use it. This proposed situation fits perfectly into that methodological demand and has also been research that demonstrated how discourse based on instructional text, thanks to its simple linguistic structures, supports the internalisation of a mental scientific script by students. This internalisation enabled them to sequence steps, make predictions, formulate hypotheses, analyse results and communicate them. But it went further: students generally mastered the scientific knowledge and discourse to such a level that they could lead others through an experiment they had already carried out. That autonomous verbal thought turned into public speech during the science fair, properly adapted to the context and audience.

The work has made it clear that planned discourse fulfils a double function: it helps students organise their thinking and facilitates social interaction within the scientific method. Language acts as a mediator between thought and action (Vygotsky, 1978). Students not only developed the ability to follow the steps of an experiment, but also

learned to reflect deeply on the sequence itself, to identify points for improvement and justify them in a communicative setting.

As for future lines of work, it would be enriching to test this proposal in other subject areas. Instructional text fits naturally with sequencing in the scientific method, but it would be interesting to explore and reflect on what other types of discourse, like narrative or descriptive texts, could also help sequence students' internal thinking and connect it to their public speech. In addition, at other educational stages where students have a wider range of linguistic structures, it would be valuable to see whether they can develop the necessary empathy to adapt their speech to lower levels and communicate effectively.

It would also be worthwhile to explore how to integrate this tool more systematically, to investigate how discourse can model and organise thinking in daily classroom routines, not just in specific projects like this one. This could help create a classroom where guided discourse becomes a natural habit for organising and sharing reasoning.

Finally, it would be enriching to design tools for collecting students' linguistic productions, to evaluate more precisely and objectively their progression from verbal thought to public speech. Perhaps recording the sessions would be needed to observe all interactions and analyse them more deeply. This analysis should also include much deeper observation templates. The goal is to understand the real impact of discourse on the development of communicative and scientific competences.

In conclusion, this project has shown that when language is placed in the centre of the teaching-learning process, it not only helps connect verbal thought with public speech, but with the right choice of discourse, it supports the development of students who are critical, autonomous, and reflective. This proposal invites reflection on how much and how carefully we plan the discourse used in the classroom, and on the value of doing so in a proper, sequenced way.

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9.ANNEXES

Annex 1: Summary of the sequence of lessons. Unit template.

Lesson	Summary	Challenge	Resources	Key competences	Main contents
1	Introduction to instructional texts through oral instructions to guide a classmate.	Complete a route in the playground by guiding a partner.	Blindfolds, route sheets, cones.	Linguistic communication, social and civic competence.	Spatial directions (turn right, turn left, go straight on).
2	Creation of instructions on a grid map with city places.	Create and follow instructions to go from one point to another on the map.	Grid maps, pencils, building cards.	Linguistic communication, learning to learn.	City vocabulary, directional sequences.
3	Programming Kubo by following an instruction sequence.	Program Kubo to collect objects along a route.	Kubo robot, programming tiles, grid board.	Linguistic communication, digital competence, science and technology.	Basic programming sequences, instructions.
4	Preparing and showing Kubo to students from 2ºA.	Guide others through a small Kubo challenge.	Kubo, tiles, grid board.	Linguistic communication, social and civic competence, digital competence.	Programming sequences, instructional texts.
5	Discovering push and pull forces through experiments.	Test how different forces affect objects.	Boxes, ropes, different weights.	Science and technology, learning to learn.	Push / pull, effects of force.
6	Exploring the stability of structures by pushing and observing.	Classify structures according to	Bottles, boxes, LEGO	Science and technology,	Stability of objects, classification by resistance.

		stability after tests.	constructions, tables, chairs.	learning to learn.	
7	Observation and classification of natural and artificial structures.	Identify and classify structures from the school environment.	Field notebooks, structure image cards.	Science and technology, social and civic competence.	Natural / artificial structures, weak / strong structures.
8	Building a tower that stands on its own.	Design and build a tower that can stand and resist a soft push.	Wooden sticks, plasticine.	Science and technology, learning to learn, social and civic competence.	Design and construction, stability of structures.
9	Building a bridge that can resist different weights.	Design a bridge that holds three weights without falling.	Sticks, plasticine, weights (blocks).	Science and technology, linguistic communication.	Design of resistant structures.
10	Preparing the display and the presentation for the science fair.	Design a visual support and plan the speech.	Poster board, markers, bridge materials.	Linguistic communication, learning to learn, social and civic competence.	Instructional texts, organisation of the presentation.
11	Rehearsing the science fair presentation.	Practise the experiment guide presentation.	Display, bridge materials, weights.	Linguistic communication, learning to learn.	Instructional discourse, effective communication.
12	Science fair: guiding classmates through the experiment.	Guide other students in the bridge experiment.	Display, bridge, weights.	Linguistic communication, science and technology, social and civic competence.	Scientific explanation, guiding using instructional texts.

Annex 2: Science Fair Observation and Rubric Sheet

STUDENT NAME:

Criteria	Excellent	Very good	Good	Needs improvement	Comments
Communication	The student speaks clearly and fluently, adapts their speech to the audience's level and uses instructional text and non-verbal language effectively.	The student speaks clearly, generally adapts their speech, and uses the instructional text and gestures in most parts.	The student speaks understandably, shows some adaptation, and uses the text or gestures with support.	The student finds it hard to communicate clearly or adapt speech, needs support to use the text or gestures.	
Scientific explanation	The student explains steps accurately, connects actions to scientific concepts, and shows confident understanding.	The student explains steps clearly, includes most concepts, and shows good understanding.	The student explains steps with support, includes some concepts, and shows basic understanding.	The student struggles to explain steps, needs help to connect actions with concepts.	
Team cooperation	The student contributes actively, listens, supports peers, and encourages group work.	The student works well with peers, supports when needed, and shows a positive attitude.	The student generally works with peers, sometimes needs reminders to support or listen.	The student has difficulties cooperating or sharing tasks.	
Problem solving / supporting others	The student identifies problems early, suggests effective solutions, and helps peers	The student identifies problems, suggests solutions, and helps when asked.	The student notices problems with help, suggests simple solutions, helps with encouragement.	The student rarely notices problems or offers solutions, needs help to support others.	

	without being asked.				
Autonomy	The student leads tasks confidently, makes decisions independently, and rarely needs help.	The student completes tasks mostly on their own, asks for help when needed.	The student needs occasional guidance to stay on track or finish tasks.	The student needs frequent guidance or finds it hard to work independently.	

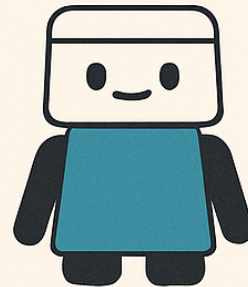
*This template is originally designed for impression in one sheet.

PROGRAM KUBO

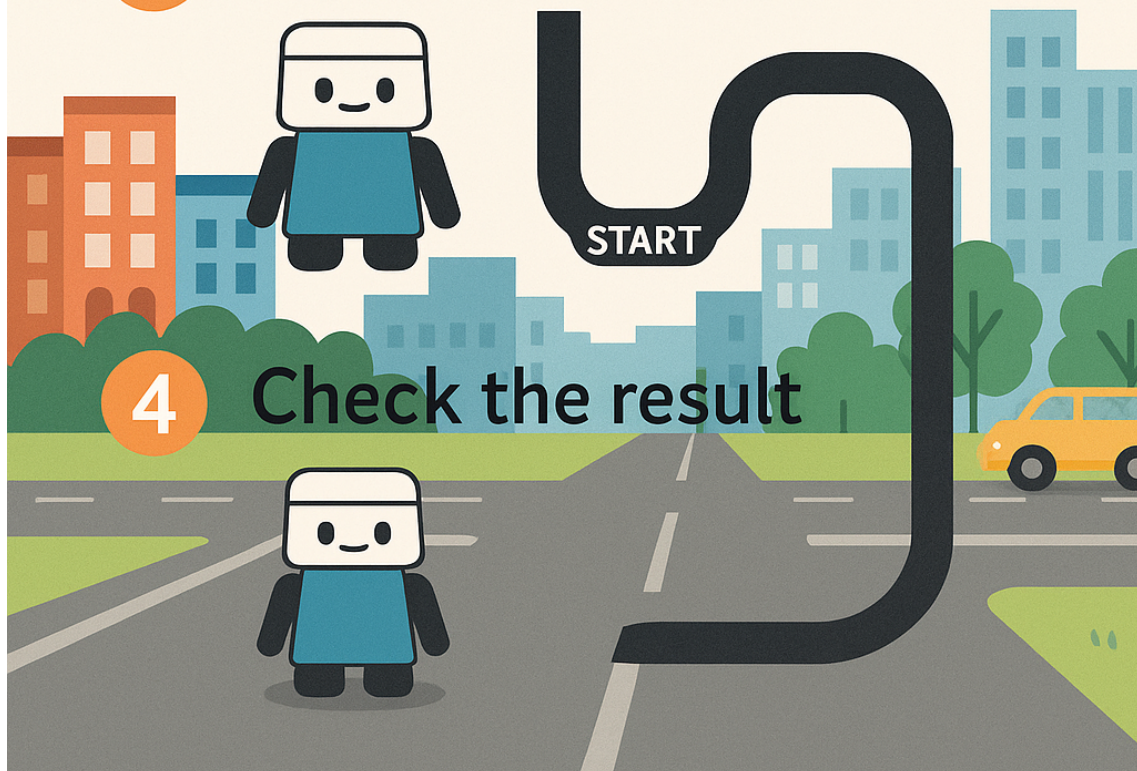
- 1 Write the sequence



- 2 Program Kubo



- 3 Place Kubo on the start



- 4 Check the result

Annex 4: Lesson 4 Observation sheet

Date: _____

NO.	STUDENT NAME	CONFIDENCE IN PRESENTATION (HIGH / MEDIUM / LOW)	CLARITY OF ENGLISH USE (HIGH / MEDIUM / LOW)	TEAMWORK (COOPERATIVE / NOT COOPERATIVE)	SPECIFIC OBSERVATIONS
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					
16					
17					
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24					
25					

Annex 5: Principal instructional texts

Lesson	Instructional Text	Purpose
Lesson 3	How to program Kubo: 1. Write the sequence. 2. Program Kubo. 3. Place Kubo on the start. 4. Check the result.	To guide the programming activity with Kubo.
Lesson 8	How to build a standing structure: 1. Take sticks and plasticine. 2. Plan how you want to build the tower. 3. Build the tower with the sticks and plasticine. 4. Check if it stands. (Tip: You can use triangles to make it stronger.)	To guide the construction of a standing structure.
Lesson 9	How to build a bridge: 1. Take sticks and plasticine. 2. Make a base for the bridge. 3. Use sticks and plasticine to support the base. 4. Test the bridge with small objects.	To guide the bridge-building task.

Annex 6: Assess resource

The students will be able to decorate and embellish their worksheet. Let’s remember that it will be laminated and used in every session.

Assessment

	PERSON			
CRITERIA	ME			

Annex 7: Example of a Science Fair Display

⑨ BUILDING A BRIDGE ⑨

Help

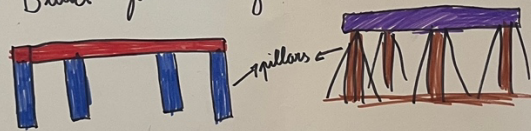
Good job. ✓
Try more pillars.
Try more plasti.
Put more sticks.
Go to step 1.

Instructions

① Think in structures you know. ?!

② Design your bridge. 

③ Build your bridge.



④ Test it:

 Charge 1 → Fall → Step 1
↓
 Charge 2 → Fall → Step 1
↓
 Charge 3 → Fall → Step 1
↓
Finish ✓  

Materials

Sticks //

Plasticine 

Charge 1



Charge 2



Charge 3

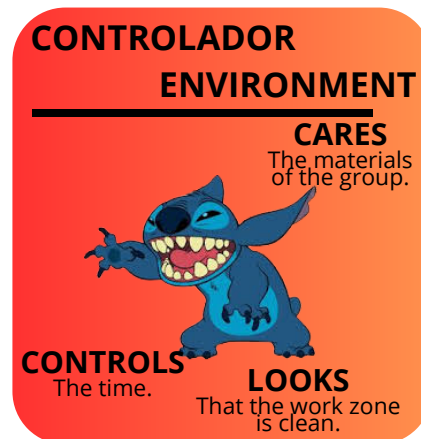


Annex 8: Images of the lessons

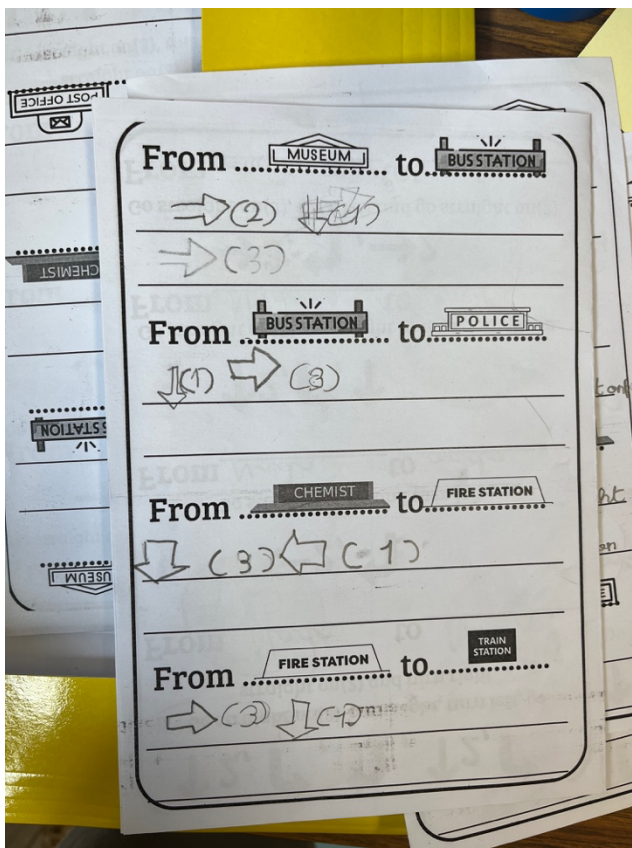
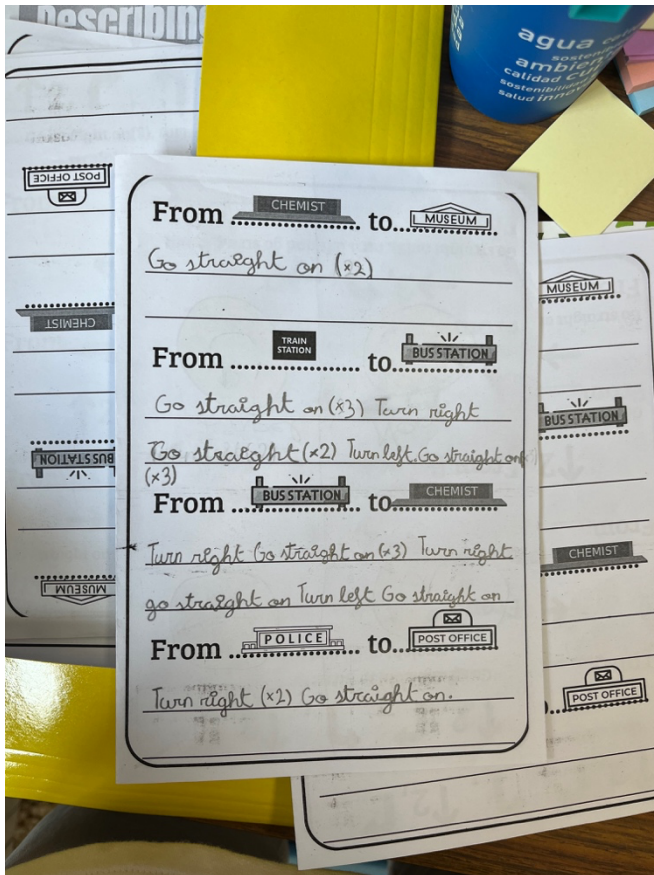




Annex 9: Group Roles emblems



Annex 10: Lesson 2 students' sheets



Annex 11: Sequence of Lessons for Developing Communicative Competence through Instructional Texts and Programming

Block 1

In this first block, we will begin to prepare students for the communicative presentation of an instructional text. Through content related to giving instructions and programming sequences, the goal is for students to develop their communicative competence while also learning how to learn by using ICT tools.

Block 1- Lesson 1

To introduce students to instructional texts and help them become familiar with the ability to follow and give directions or commands, we will start with this activity. In it, not only will the previous objectives be worked on, but spatial awareness and cooperative work will also be developed. In this way, following the CLIL approach, the goal will be to work on both foreign language content and social science (road safety, directions) in an integrated way, as promoted by the LOMLOE when encouraging interdisciplinary treatment of subjects (Spanish Government, 2020). This will be done through the type of text that represents this content: imperatives, used in a vehicular and mostly oral way, as established by the Common European Framework of Reference for Languages (Council of Europe, 2022).

The lesson begins with a whole-class activity led by the teacher, in which the basic instructions are introduced rhythmically to support language internalisation, promoting the development of inner speech, a key concept in thinking and self-regulation according to Vygotsky (1978). These are the three basic directions that will be introduced, aligned with the ones that Kubot will be able to perform by the end of this block: turn right, turn left, and go straight on.

After introducing the contents in the classroom, we will go to the playground, where students will work in pairs. A series of itineraries will be shown on a worksheet that they must complete, with one student acting as the guide and the other moving forward blindfolded. They will be free to give meaning to each direction, for example, some students may decide that go straight on means two steps, while others might adjust by saying go straight on a little... Each pair will have its own way of connecting speech and action.

Once the itineraries are completed, students will be asked to create one predictively. Both must start from a location and arrive at another, using the same dynamic as before, but this time, they must predict what their speech and directions will be, in other words, their instructional text. It is not necessary for them to write full sentences; a simple sequence of arrows will be more than enough. They must follow that text, and if they make a mistake, they will return to the starting point and reformulate it, analysing possible errors and adjustments. This dynamic allows students to face an authentic task with a real communicative goal, in which they must formulate, apply, and revise their oral production. This aligns with the principles of task-based learning, as described by Ellis (2003).

As this first session involves work in pairs, rather than groups, students will simply be asked to evaluate themselves through peer and self-assessment, using a colour code. The two items that will be assessed are the directions given and the work, with a special focus on attitude.

Block 1- Lesson 2

Now that we have introduced the contents and started to create our own instructional texts in a sequenced way, we will continue guiding the learning process towards the ability to produce instructive texts for the final task or challenge of this block. In this session, we will work on these steps in a more analytical way, losing a bit of the experiential side of the previous task and moving towards giving directions from the perspective of a map, adding content from other areas. We will use a grid map to make it easier to identify the references for the movements connected to each instruction. This evolution towards more analytical tasks with a clear communicative goal is aligned with the task-based approach proposed by Ellis (2003), where progression is promoted from guided practice to communicative autonomy.

Students will receive the maps with grids, and in each grid, there will be different places in a city, aligning with the foreign language content and vocabulary proposed by the textbook. This activity matches the contents of the foreign language curriculum related to city vocabulary and spatial orientation, following the official curriculum of Castilla y León, which supports the integrated work of basic knowledge through contextualised

tasks (Junta de Castilla y León, 2022). At first, students will work in groups and will have to reproduce the instructional text that takes them from one place to another. This can be done by writing or by drawing arrows, the main goal is clarity, so that the message can be understood by others, promoting the comprehension and production of functional texts typical of levels A1-A2 of the Common European Framework of Reference (Council of Europe, 2022). Once the four instructional texts for the four itineraries assigned to the group are completed, they will exchange texts with another group.

This is where the second part of the lesson begins. With the texts from the other group, students must discover the starting and ending points of each route on the map (for example, from the train station to the bus station). After the set time has passed, whether they manage to match all the texts correctly or not, the groups will mix, and in new pairs formed by one student from each original group, they will evaluate both their own texts and those from the other group, using our colour code.

With the final task of the session completed, students will start their evaluation routine using their self and peer assessment rubrics. For this lesson, the criteria they will consider are work, written discourse, investigation, and collaboration:

- Work: referring to their attitude and involvement in the tasks.
- Discourse: the same for the whole group, evaluating the quality, suitability, and clarity of their instructional texts.
- Investigation: this refers to the contribution made to discovering and matching the texts to the correct itineraries.
- Collaboration: in this part, they will reflect on how it was to work with that partner.

Block 1- Lesson 3

Kubo is a manipulative educational tool designed to introduce students to programming and sequencing in a much more hands-on way than usual. The robot memorises a sequence that is created using tiles that work like a linear puzzle. In this way, the way we introduce and programme the robot's movements is closely connected to a sequence of instructional text. Once the sequence is memorised, the robot is placed on a grid board, similar to the one used in the previous lesson, in line with the competence-based and cross-curricular approach promoted by Decree 37/2022 of the Primary Curriculum in Castilla y León (Junta de Castilla y León, 2022). On that board, a starting tile is placed,

and when Kubo is set on it, it will follow the memorised sequence from that marked square.

The session will follow the same methodology and educational principles as the rest of the unit. Working in groups, students will have Kubo tile simulations and will create their texts as a team. The idea is that three groups will create texts and three groups (those with access to the physical Kubo) will be the receivers. These roles will be switched during the final part of the lesson. First, the groups will prepare their texts to move from one place to another using the reference board and the possible starting points marked on it. Their goal will be to make Kubo pass over a series of objects, as if collecting them. The key to this proposal is the freedom of execution, it is a challenge with infinite possible solutions, and therefore, since it can be done in different ways, it adapts to the needs of each group. Some may solve it with one long sequence, others with several short ones... which fits the methodological principles and diversity attention of the LOMLOE (Spanish Government, 2020).

Once the texts are ready, the students acting as receivers will prepare to programme Kubo. The sender group must orally reproduce the text they have created, connecting each tile with a type of imperative sentence, thus developing their ability to give and follow instructions in real situations (Council of Europe, 2022). In the ANNEX, there is a table showing the link between each tile and the corresponding imperative sentence. After saying their text, their sequence of imperative sentences, the receiving students will add the tiles to the programming sequence. Once completed, Kubo will memorise the path and carry it out. There will be some time for students to adjust possible mistakes in their text, so they must follow Kubo's path and identify where the mistake is. Once solved, the groups will switch roles.

After completing the final task and solving the challenge, each student will take their assessment sheet to carry out the day's peer and self-assessment. This time, the criteria will be work, as always, and text, referring to their participation in the creation of the instructional text.

Block 1- Lesson 4

This activity ends the first block, in which, through the use of language, we introduce students to the text structures needed for the development of the science fair. This first block serves as a preparation stage, a kind science fair preview, where students begin to practise routines and get familiar with both the linguistic contents and communicative competence, without forgetting knowledge from other areas. This follows the competence-based and cross-curricular approach promoted in the curriculum of Castilla y León, which supports the connection between subjects through global and contextualised learning situations (Junta de Castilla y León, 2022).

This lesson is based on two key methodological aspects: peer teaching and Design Thinking. Students must give a demonstration to other pupils from the same year but a different class, showing them how Kubo works. They will not teach them in a traditional or transmissive way, but through demonstration. Students must understand how Kubo works and how to sequence and code its programming, as they did in the previous lesson. Once they are clear on all these aspects, they will design one or more programming sequences to demonstrate the functions they know.

To do this, students need to empathise with what their classmates already know about the robot which, in this case, is almost nothing. So, they will be aware that this will be the first time their classmates see and use it, and they must carry out a clear and simple demonstration. Following the structure of the previous lesson, students will use iconic tiles that represent the Kubo programming pieces to build their instructional text. Each of these tiles is linked, as mentioned before, to an imperative sentence, which allows students to produce short and functional oral texts to give instructions, as required by the CEFR. This text will serve as a kind of script to guide the oral explanation they give to the students of 2ºA. After doing several demonstrations, they will propose a challenge to their classmates and help them solve it, something similar to what they themselves did in Lesson 3. This whole sequence will be prepared in advance by the 2ºB groups at the start of this lesson.

For the peer and self-assessment, the criteria for this session will be: work, as in all lessons, design, referring to the creation of the instructional text and presentation, referring to the demonstration moment with the 2ºA students.

Block 2:

The following lessons start a new unit in terms of content, focused on forces and structures, but they continue to aim at developing key competences such as scientific thinking and communicative competence. Through these lessons, students will have to solve different challenges that will serve as subtasks to help them develop related competences and prepare for the final challenge, the science fair.

Block 2- Lesson 5

This lesson starts the second block of content in this teaching proposal. Here, we will focus on forces and structures, following the basic knowledge established by the LOMLOE. Regarding the language aspect, we will continue using instructional text as a method to organise thinking. The main goal of this first session is for students to learn about the forces of pull and push from a purely experiential and practical perspective. In other words, the idea is for students to experiment with these forces and observe how they affect an object.

We will begin with a whole-class activity led by the teacher. The aim is to activate the students' inner speech and connect pull and push with their corresponding motor icon, represented by hand gestures. This helps students internalise language as a tool for thinking and self-regulation, in line with Vygotsky's sociocultural theory (1978). The activity will be short and introductory. Students will perform different actions, such as making the hand gestures, pushing or pulling a classmate, or doing the same with classroom chairs depending on the instructional sequence said by the teacher.

The next activity will be a memory-style game, where students must connect flashcards showing action images and classify them as push or pull. After these two warm-up activities, we will move to the main task of the lesson, which is divided into two parts. First, three groups will do one activity and then switch with the other three groups doing the second activity. This station-based structure allows for effective management of cooperative and hands-on learning, as promoted by the regional curriculum (Junta de Castilla y León, 2022).

The first activity is focused on the push force. Students will receive two instructions as instructional text:

- “Push the object hard”
- “Push the object soft”

With these two instructions, students will measure and record the distance an object (with medium weight) travels when pushed. After this first experiment, they will repeat the same process with different objects. Before testing them, they must predict whether the object will travel farther or shorter than the first one. After that, they will compare their predictions with the real results.

The second activity, which happens in parallel, focuses on the pull force. The other three groups will work with a rope and a box, and they will record how difficult it was to pull the box depending on variables given by the teacher. Following the linguistic approach of this proposal, students will receive a sequence of two imperative sentences, which will change each time they carry out a test, keeping the structure but changing the variables.

The first instruction will be: “Put the...” (the different objects required) “...in the box.”, which controls the weight.

The second instruction will be: “Pull the rope with one hand” (or “with two hands”, or “between two/three persons”), which controls the pulling force.

After the teacher gives the instructions, students will carry out the experiment and record how hard it was to pull the box on a four-level scale: very hard, quite hard, a bit hard, and not hard. Afterwards, the three groups at each station will rotate, so all students will work on both the pull and push activities. The teacher’s role during the session will be to guide the experiments through language.

To end the session, students will complete their self and peer assessment using the familiar table. This time, they will assess only two aspects: work, how they approached the tasks and how they felt working, both individually and with their group members.

Block 2- lesson 6

In this lesson, we will try to build a pedagogical sequence that works as a natural bridge between forces and structures, connecting the core basic knowledge of this block in the teaching proposal. The idea is to introduce, in a visual and experiential way, key concepts related to structures, such as stability, resistance, or shape, without naming or defining them in a theoretical or conceptual way. Following Vygotsky’s sociocultural theory, this

lesson uses language and physical interaction as mediators of thinking, enabling students to gradually internalise scientific concepts through guided experimentation (Vygotsky, 1978).

The instructional text for this lesson is simple. Throughout the different subtasks, students will always follow the same steps:

- “Push it softly.”
- “Push it hard.”
- “Record the results.”

This will be the pattern students must follow to experiment with the different structures that will be presented. One important rule is that, to help the proper development of the tasks, students must always return the object to its original place after pushing it, and of course, they must make sure the activity is safe for themselves and others, meaning there should be no risk of getting hurt or damaging anything.

Students will receive a worksheet where they will take pictorial or written notes about the objects and different structures they experiment with, and what happens when they push them in both ways. To start the task in a more guided way, we will place around the classroom and hallway different structures or objects with more or less stability, such as bottles, water containers, boxes with different amounts of content, plasticine constructions, LEGO buildings, and they will also be allowed to use other available classroom and hallway objects such as tables, shelves, benches, chairs, or anything they think they can push without breaking.

Following the usual cooperative work dynamic, one of the students will take the role of secretary, collecting the names of the objects and the results of the experiment, that is, whether they were able to move them or not. Once the experimentation time is over, we will give students a worksheet with three circles: one red, one yellow, and one green. In them, they must draw or write the objects they pushed, classifying them as follows:

- In the red circle, if they couldn't move the object.
- In the yellow circle, if they were able to move it a little.
- In the green circle, if they moved it easily.

Once this dynamic is completed, students will do their usual self and peer assessment, using the familiar routine. This time, the criteria will be work, experimentation, classification, and safety. Including safety as an assessment criterion reinforces responsible behaviour and encourages students to be mindful of others, fostering social and emotional learning alongside scientific inquiry.

Block 2- Lesson 7

With this lesson, we begin the development of activities focused on structures, which form the core element of this teaching proposal. From an experiential and guided approach, students will explore the different types of structures and learn how to classify them. The goal is for students to develop competences that allow them to have a scientific, critical, and reflective attitude towards both natural and artificial structures around them.

We will start with a classroom activity where students are introduced to the adjectives needed to classify and label structures: natural, artificial, weak, and strong. Each group will receive a field notebook where they will draw or write about the structures they observe and classify them — similar to the previous lesson. The classification must first be natural or artificial, and then weak or strong.

After the introduction and explanation of the main task, students will be allowed to explore different parts of the school, both inside and outside, always in a respectful way. They will take notes on the structures they observe and classify them using the criteria introduced before. This follows the Castilla y León curriculum, which promotes learning through the local environment, education for coexistence, and the connection between areas of knowledge (Junta de Castilla y León, 2022).

Once back in the classroom, there will be a whole-class group task using flashcards. The groups will receive cards with different types of structures — designed to be familiar and from their surroundings — and they must classify them by sticking them on the board in the area for either artificial or natural structures.

Before starting the metacognitive reflection, we will ask: “Are there any pillars?”, while showing an image of a pillar. After one minute, the group speakers will have to tell us

how many of the structures they recorded have pillars, to introduce this key concept, which will be essential for the final experiment and the science fair.

This lesson not only allows for the introduction of content and knowledge about structures based on the students' real environment, but also supports the development of competences related to critical thinking, cooperation, and autonomy. In addition, language is used as a tool for investigating and discovering.

Once the tasks are completed, we will move on to the self and peer assessment moment, promoting self-regulation and formative assessment through clear criteria such as work, respect, and observation, in line with the model proposed by Black and Wiliam (2009). By observation, we refer to the students' ability to contribute when identifying and classifying structures. We introduce respect as a criterion because most of the activity will take place outside the classroom, and we must encourage a respectful working atmosphere with the whole school community.

Block 2- Lesson 8

With this session, we begin to introduce the challenge-based methodology, where students must build structures that pass a series of tests. The main objective is for students to use the observation, visualisation, and analysis done in the previous session to build a structure that can stand on its own.

The challenge we present to the students is simple: they must build a structure that remains standing and resists a small push and pull on the table without falling. But those are not the only conditions, the structure must also be as tall as two water bottles, which they will use as a reference. The instructional text we give them to help sequence their steps and support scientific thinking is:

- "Think in the structures."
- "Design your tower."
- "Test the tower."

Groups will have plasticine to join the main building materials, which are thin wooden sticks. The idea is for students to experiment and test the tower under different conditions. If we see that a group is struggling because of the way they designed the tower, we will

stop the session briefly and talk about a real structure from their surroundings that includes triangles, which help to support buildings, in our case, the iron bridge.

To ensure that all groups are able to complete the challenge, if one group finishes early and passes the challenge (and even any additional variation we propose), its members will be split and sent to other groups to help them. This peer support strengthens learning in the Zone of Proximal Development (ZPD), as more advanced students act as mediators to help their classmates overcome the task, as explained by Vygotsky (1978). At this moment, the teacher's prior observation is essential in order to assign these helpers strategically, depending on how the groups are progressing with their constructions.

Once the building time is over and all groups have completed the challenge, we will move to the self and peer assessment stage. This time, the criteria will be work, how students participated in the task; design, referring to the planning stage of the structure and construction, referring to the main process of building the tower.

Block 2- Lesson 9

This session marks the beginning of the science fair dynamic. In fact, at this point, the science fair will be officially introduced to the students, and they will be told that this experiment will be a key part of it. In this lesson, there is progress compared to the previous construction: the structure must not only stay upright, but also withstand a series of weights. In this way, students will work on the concept of resistant structures, and they will connect the parts and shapes of a structure with its strength and stability.

The textual structure we will use to model their steps and support their scientific thinking is essentially the same as in the previous session, with slight variations:

1. "Think in the structures you know."
2. "Design your bridge."
3. "Try with charge 1. Does it fall? Yes, go to step 1. No, go to step 4."
4. "Try with charge 2. Does it fall? Yes, go to step 1. No, go to step 5."
5. "Try with charge 3. Does it fall? Yes, go to step 1."

Each group will receive their materials, managed by the controller or resource keeper. The rest of the session will follow a similar dynamic to the previous one. Students will

experiment, making indirect predictions about whether their structure will hold or not, and then test them by adding weights. If it fails, they go back to the design stage. This cycle of reflection, action, and readjustment responds to the idea of cognitive mediation through language, as proposed by Vygotsky (1978). The whole session will be dedicated to solving this challenge.

As before, if any group completes the challenge early, they will again be used as helpers, redistributed among other groups to help guide their classmates — without giving away the solution. This peer collaboration and the strategic use of students as tutors supports transfer of learning, shared responsibility, and joint knowledge construction (Zabala & Arnau, 2007).

Once everything is finished and all groups have successfully solved the challenge, we will move on to the metacognitive self and peer assessment. The criteria for this session will be the same as in the previous one, work, how students participated in the task; design, referring to the planning stage of the structure and construction, referring to the main process of building the bridge.

Block 2- Lesson 10 and 11

The main goal of these two sessions is to prepare students for their active participation in the science fair, which will follow the peer teaching methodology explained in the theoretical framework. This approach supports the development of autonomy, communicative competence, and social interaction, as stated by the LOMLOE regarding active methodologies and contextualized learning situations (Spanish Government, 2020). Each of the six groups will go to one of the primary classes to present their experiment and guide their peers through the process. A double challenge is posed—both communicative and organizational—in which students must empathize with their audience in order to design their speech according to the characteristics of the learners they will work with. For this reason, it is key that the teacher assigns each group to a specific grade, based on the match between the group's potential and the target audience.

Lesson 10 will focus on the design of the intervention, including the planning of the oral presentation and the creation of a multimodal text to support the language use. This process fits into the Design Thinking approach applied to the educational context (IDEO, 2015). The design should serve as a tool to empathize with the audience, define a message, and communicate it clearly and meaningfully.

Each group will complete three main tasks during this session: the design of the display, the preparation of the oral text, and the internal organization. First, students will design a display to support their communication. At the centre, it will include the title of the experiment ("Building a Bridge") and the instructional text they used in Lesson 9. They will also add a section with the materials and an image or drawing of the proposed activity.

Regarding the text, students will not write the instructional text themselves, as it is provided by the teacher. However, in addition to that, they will need to include a set of communication tools in their "backpack" to help them deal with peer teaching situations and potential difficulties. These will be:

- Good/great job: It is essential for students to understand that they must give positive feedback to encourage their peers. In the case of younger learners, it is especially important to combine this with a thumbs up, using non-verbal language.
- Try with triangles / try with more pillars: During construction, students may need to adjust their design. These phrases will help guide their peers by suggesting changes such as using triangles to support the structure or adding pillars to distribute the weight.
- Use the (name of material): This simple imperative sentence will allow students to suggest material choices or changes in where they are placed.

With these phrases and the instructional text, students should be able to guide others through the experiment. The next step will be to organize the speech and assign the roles each team member will take during the presentation at the science fair. This distribution should be balanced in participation, though not necessarily equal in speaking time, and students will have freedom to decide how to manage it.

During Lesson 11, students will have time to prepare and rehearse their presentation. This guided rehearsal and peer feedback will support the self-regulation of learning and continuous improvement of their performance, in line with the principles of formative

assessment (Black & Wiliam, 2009). The goal is for every student to feel ready, confident, and coordinated when delivering the presentation.

After a period of group preparation, three groups will act as audience and three will do a more realistic rehearsal performance for a specific audience. Then, they will switch roles, and this dynamic will be repeated as many times as needed.

Block 2- Lesson 12

This final session is meant to demonstrate and consolidate the competences developed and the learning achieved throughout all previous lessons. In this science fair, the Year 2 students will have their own stand and display, and they will welcome a group of students from different primary levels, carefully selected in advance by the teacher. This activity puts into practice scientific content, as well as communicative, interpersonal, and metacognitive competences, all integrated in a real situation where students learn by teaching.

From a methodological point of view, this session represents a task framed within task-based learning (Willis & Willis, 2007) and challenge-based learning, where learning takes place through a functional activity. Students face the final challenge of the proposal: after completing the previous subtasks, they now have to become teachers and guide their schoolmates through the experiment.

Each group will use their display to support their communication, but they will also rely on the prepared speech from Lessons 10 and 11. Through the preparation of these texts, students are not only working on language structures, they are integrating them into their communicative competence while using them to organise their thinking through language. This dimension of language as a mental planning tool connects directly to Vygotsky's sociocultural theory (1978). Students will not only communicate; they will also think, self-regulate, and transform their knowledge through meaningful interaction.

The session has a double objective: to ensure that students can clearly explain the experiment and that the visiting group is able to carry it out successfully. In this way, knowledge transfer (Zabala & Arnau, 2014) and peer learning (Duran & Vidal, 2004) are

also developed, promoting the organisation, verbalisation, and adaptation of knowledge in order to make it understandable for others.

During the development of this session, the role of the teacher is to act as facilitator, support, and observing evaluator. It is essential to supervise the entry and exit of visiting groups and make sure that all materials are ready, even though this is also the responsibility of the resource keeper. Moreover, the teacher must ensure that a safe, respectful, and cooperative environment is maintained. Finally, it is important to gently support the groups that show more insecurity, in order to create a trusting and safe learning space.

Once the science fair ends, it is time for the final metacognitive moment, in which students will complete their self and peer assessment using the following criteria:

- Work: their attitude and commitment during the tasks.
- Design: how they worked during the preparation phase in Lessons 10 and 11.
- Fair: how they performed during the science fair itself.